highlights
of agricultural research

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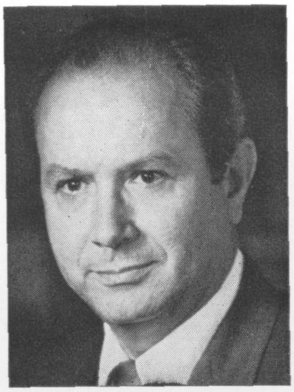
Agricultural Experiment Station
R. Dennis Rouse, Director

Auburn University
Auburn, Alabama

DIRECTOR'S COMMENTS

HOW MUCH is agricultural research worth? We have always been concerned with profit or benefit from investment of capital or labor. Today, the popular term is cost-benefit ratio and it is important that the public be concerned about this ratio in publicly supported research.

Over the years, many detailed studies have been made of benefits relative to cost of agricultural research by State Agricultural Experiment Stations and USDA, but none recently. In recent weeks, two studies which complement each other have been reported and several interesting comparisons made. They show that from 1939-1973, funding for publicly supported production agriculture research and extension increased at 3% per year but inflation during this time increased at 4% annually. Therefore, a net decrease in research and extension purchasing power resulted.



R. DENNIS ROUSE

Records show a considerable shift in the kind of research and educational programs. Even so, analyses showed that for each dollar spent during the period 1939-1973 on production agriculture research and extension (State Agricultural Experiment Station, State Cooperative Extension, and USDA), the value of agricultural output of this Nation equated to a constant 1958 dollar increased $4.30. Analyses also point out a multiplier factor associated with agricultural production which increases total net benefit from agricultural productivity by 1.6. This is an impressively favorable total net benefit to cost ratio.

When past performance and potential benefits were analyzed for various specific areas of research and benefits projected over the next 25 years from investing additional dollars into research, favorable returns are indicated. For example, investments in beef and forage research are projected to provide an annual rate of return of 16.5%, additional investments in corn research 32%, soybeans 31%, swine over 50%, and dairy 38%.

The committee of scientists who made this economic analysis represented every region of the United States and I have confidence in their report. Their data show agricultural productivity growth in the United States since 1939 has been at the rate of 1.85% compounded annually. Public and private research together with extension and education account for a major part of this increase, because they account for technology and diffusion.

This performance is more striking when one considers that it was accomplished with decreasing purchasing power and a broadening of diversity of problems the public demands be given attention. A major component of this broadening is the necessity for more research resources to be diverted to defensive research. (Defensive research is that conducted to prove or re-prove, generally for the sake of regulatory agency, something that is already known and accepted as valid in the scientific community.) A recent study by the Agricultural Research Institute indicated that 20% of the agricultural industry research effort in this Nation is defensive research. If present trends in regulatory activity continues and unless there is a significant increase in public research support, this could reach 50% within 10 years.

It is essential that agricultural research capabilities, developed with such great effort in this State and Nation, be maintained and sustained. This capability needs to be recognized as a public resource that must be fostered – not a public expense that should be curtailed. It is an investment in both the present and future well-being of all living persons and their descendents.

may we introduce . . .

Dr. Eugene W. Rochester, Jr., Assistant Professor of Agricultural Engineering, is author of the story on page 3 that describes the new center pivot irrigation system being used to irrigate field research areas at the Wiregrass Substation, Headland. His work in setting up this system to eliminate drought as a limiting factor in field crop studies is just one phase of his research efforts dealing with various aspects of soil and water research. In addition to studies concerned with efficient use of irrigation water for crop production, he is also working on projects dealing with soil drainage and other water-soil relationships.

A native of Greenville, South Carolina, Rochester did his undergraduate study at Clemson University and received both M.S. and Ph.D. degrees from North Carolina State University. He joined the Auburn faculty in 1970 with a joint teaching and research appointment in the School of Agriculture and Agricultural Experiment Station.

He holds membership in American Society of Agricultural Engineers, National Society of Professional Engineers, The Irrigation Association, and the honor societies Gamma Sigma Delta and Alpha Zeta.

HIGHLIGHTS of Agricultural Research

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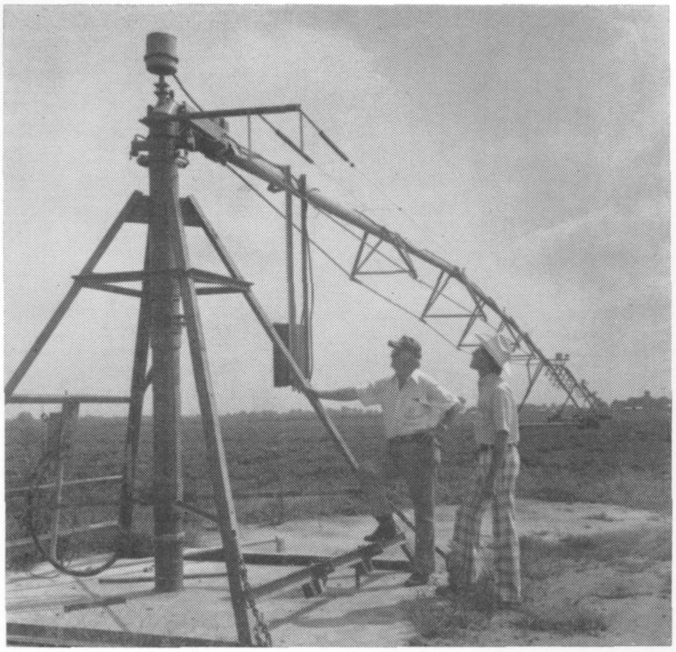
ON THE COVER. This irrigation system permits irrigating field crop test areas at the Wiregrass Substation, see story page 3.



Center pivot irrigation system used to irrigate experimental peanuts and corn at the Wiregrass Substation, Headland.

Center Pivot Irrigation Provides Flexibility for Field Research

EUGENE W. ROCHESTER, JR., *Dept. of Agricultural Engineering*
JAMES G. STARLING, *Wiregrass Substation*

RECENT INNOVATIONS in irrigation equipment have renewed interest in irrigation throughout the Southeast. These innovations have provided a way of applying water with a minimum of disturbance to other field operations, while giving a profitable return on the farm investment.

One of the innovations is the center pivot irrigation system, which is being used on many Alabama farms to irrigate large square or circular fields. Center pivots as large as 400-acre capacity have been installed in some regions of the Nation, but the most common size fits a quarter section of land and irrigates 130-150 acres.

Although the needs of field research differ from farming requirements, a center pivot system is providing needed flexibility at the Wiregrass Substation, Headland. Field experiments with peanuts, soybeans, and corn are conducted at this unit of the Auburn University Agricultural Experiment Station. Projects vary from studying cultural practices to disease and pest control. In past years drought often caused moisture stress, which frequently reduced effectiveness of the research. Now that the irrigation capability has been added, field research can be conducted under ideal soil moisture conditions.

The five-tower, 40-acre, center pivot system shown in the photograph was used in 1976 to irrigate corn on 20 acres and peanuts on 20 acres. Numerous plot experiments were incorporated in the peanut acreage. Effect of soil moisture content was not studied, but high moisture levels were desired to avoid yield losses from moisture stress.

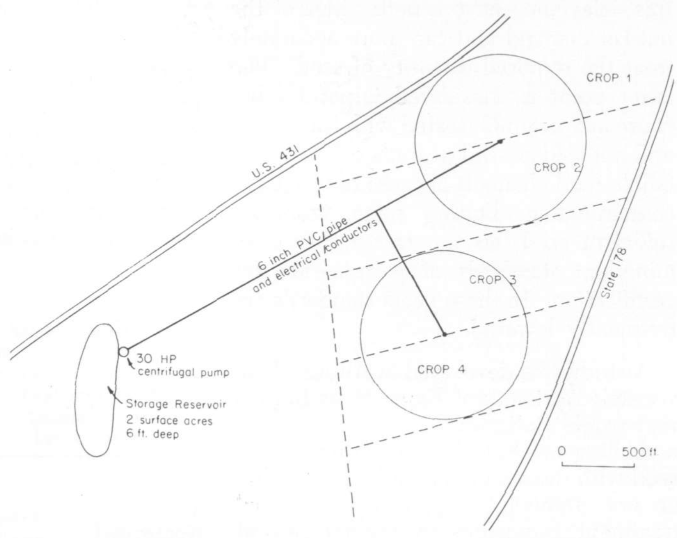
Operation of the center pivot system is relatively simple. The motor-driven (electric drive) system is positioned at the edge of the peanut field, the pump is started, and a semicircular area of peanuts irrigated. Watering is stopped at the desired location by an automatic stop system (a switch and mechanical positioner called a pre-selected stop). The system can then be used to irrigate peanuts again or be moved to any location in the corn field.

The pre-selected stop can be adjusted to irrigate specific plots to determine effects of irrigation, and wedge-shaped plots can be identified and randomized. The electric drive is used to position the towers at the beginning of the plots. Then the pump is started, the plot is irrigated, and finally the system stops automatically at the desired location.

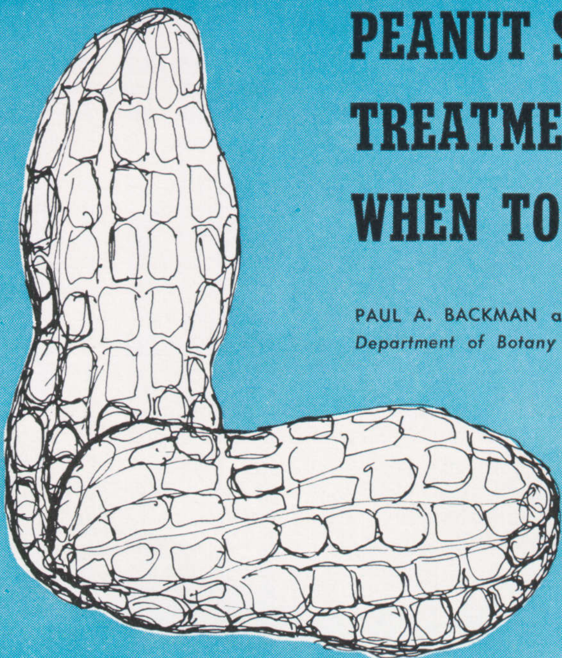
For research flexibility, two pivot locations were established with electrical wiring and pipe installed to each. The system becomes towable by turning the wheels so they are parallel to its length. It can then be moved from one section to another so extra research areas can be reached for irrigation.

As the system makes its circle, at one point the end sprinkler is close enough to wet a public road. To eliminate this safety hazard, an end gun shutoff was installed. This shutoff is simply a switch and solenoid valve which bypasses the end sprinkler as the system approaches the road. The shutoff also can be used to partially irrigate the corners of a square field.

Water for the irrigation system is obtained from a reservoir located 2,800 ft. from the pivot. A 6-in. PVC line conveys the water from the centrifugal pump to the system. Power for the drive motors is supplied by underground wires placed parallel to the PVC pipe. In addition to the 4-power conductors, another conductor circuit allows automatic pump shutdown should the system stop moving. The system is fully automated and can be operated continuously.



Drawing of center pivot irrigation system at the Wiregrass Substation illustrates flexibility for research operations.



PEANUT SEED TREATMENTS: WHEN TO APPLY

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THE PEANUT seed industry is somewhat unusual, because the harvesting (combining) operation does not leave the seed in a form ready for commercial channels. Three to 4 months after harvesting, peanut shellers must process the harvested pods to remove the shell. It is common practice in Alabama to wait 1-3 months after shelling to apply seed treatment fungicides. Shellers cite two main reasons for this delay: (1) it allows time to run germination tests on all lots to find those with highest germination, and (2) after this delay they have a better idea of the market demand and can more accurately treat the required quantity of seed. The latter point is considered important because any peanuts treated with fungicides and not sold as seed peanuts cannot enter edible food channels because of fungicide contamination. During some years insufficient seed lots are found that meet minimum standards of germination for certification. In these years standards are frequently lowered.

A study was developed at Auburn University's Agricultural Experiment Station that would indicate: (1) whether or not a shelling machine is inoculating peanut seed with disease fungi; and (2) whether or not immediate application of seed treatment fungicides to shelled peanut kernels has any advantage over delayed application of seed fungicides.

Objectives

The first objective was studied by spraying the beater bars of the sheller with broad-spectrum fungicides (Difolatan and Botran) to determine if peanut germination is improved when the sheller is "decontaminated." Test results showed no improvement under these conditions. This experiment was hampered, however, by the technical difficulty of treating the internal parts of a commercial sheller with fungicide, and by the fact that recontamination can occur as fast as untreated "moldy" peanuts enter the machine.

The second objective showed much more promise. One pound samples of peanuts were removed from the sheller immediately after shelling. Some were treated immediately with Difolatan-Botran, some were treated 2 weeks later, and some 5 weeks later. Three ounces of Difolatan-Botran (60-20) were used per 100 lb. of seed. Seed were stored at 50° ± 5° F until germinations were conducted 6 weeks after shelling. Kernel moisture content was 5.6%. Seed were stored in loosely-tied plastic bags with several replications per treatment to allow statistical comparison.

Results

The results shown in the following table indicate that peanut seeds treated immediately after shelling display increased germination compared with peanuts treated at later dates. Two types of damage were observed: (1) an increase in clean nongerminable seed with delayed treatment, indicating an increase in infections that were controlled by seed treatment fungicides; and (2) an increase in moldy seed, indicating that deep-seated infections not controlled by fungicides were more common.

These results indicate that instead of delaying peanut seed treatment until shelling is complete, seedsmen should incorporate an "in-line" system on their equipment to treat seed immediately after completion of shelling, debris removal, sizing, and electric eye examination. The magnitude of the reduction in germination indicates that an 'in-line' treating system could mean the difference between certification or non-certification of a seed lot. In addition, reduced planting rates resulting from better germination could reduce growers' costs. Finally, the seedsman would reduce costs because they would save the cost of the two bagging operations presently used, and in one operation would end up with the seed treated, bagged, and ready for market immediately after shelling.

Mention of a trademark or proprietory product does not constitute a guarantee or warranty of the product, nor does it imply its approval to the exclusion of other products that may also be suitable.

This study was supported in part by a grant from the Alabama Peanut Producers Association.

A portion of this study was published previously (Plant Disease Reporter 60:1-3).

EFFECTS OF INTERVALS BETWEEN PEANUT SHELLING AND SEED TREATMENT ON SEED GERMINATION AND FUNGAL COLONIZATION[1]

Time (weeks) from shelling to treatment	Percent total germination	Percent clean germinated	Percent clean, not germinated	Percent moldy seed
0	79.3 a	79.2a	17.2 b	3.5 b
2	72.7 ab	72.6 b	21.6 bc	5.8 b
5	70.6 b	70.4 b	23.1 c	6.4 b
Nontreated	56.0 c	8.9 c	5.0 a	86.0 a

[1] Values within each column followed by the same letter are not significantly different ($P \leq 0.05$) using Duncan's Multiple Range Test.

Egg Handling Affects Hatchability and Body Weight of Broilers

GAYNER R. McDANIEL, *Department of Poultry Science*

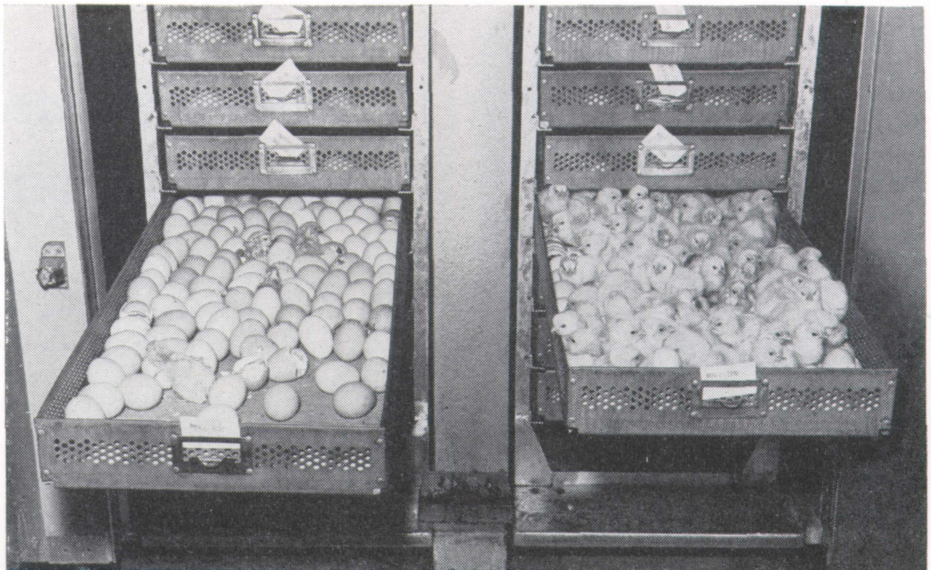

FIG. 1. Spottiness in hatch resulting from variation in time eggs were held.

HANDLING OF HATCHING eggs has a lot to do with hatchability and subsequent performance of broiler chicks. Methods of storing on the farm and at the hatchery, length of storage, and age of breeder flocks were found to have a decisive effect on embryonic mortality, chick quality, and growth rate in Auburn University Agricultural Experiment Station research.

The relationship between length of storage and hatchability is well established. A decline in hatchability is recognized in eggs held in storage for 5 days and a sharp decline is evident after 7 days. In addition, eggs held 7 days or longer show problems in the overall hatchery operation and may be responsible for "dragging" or "spotty" hatches. Eggs held for a week or less will hatch in 21 days, whereas eggs held 7-14 days are delayed 5-8 hours. Those held 15 or more days require almost 22 days to hatch.

Setting fresh along with "held" eggs or eggs from a young flock along with others from an old flock produces nonuniform hatches. Some trays in the hatcher may be completely hatched while others are just pipping, Figure 1. This practice is often responsible for poor quality chicks and above average embryonic mortality. An accurate egg inventory would eliminate guessing egg and/or flock age and allow the hatcheryman to set eggs of compatible age and storage time together. The result would be improved hatches and quality of chicks.

An Auburn study was done to determine if problems caused by holding eggs too long carry over to growing broilers. Growth rates to 8 weeks were compared among chicks from eggs held for periods of 1 day up to 21 days, trayed according to length of time held. There was a noticeable decrease in 8-week weight of birds hatched from eggs held 5 days or longer, as shown below:

Days of storage	*4-week wt., lb.*	*8-week wt., lb.*
1-7	1.39	4.11
8-14	1.37	4.06
15-21	1.33	3.95

Just how length of egg storage affects market weight of broilers is not known. It is speculated, however, that any stress placed on the embryo before incubation will adversely affect performance of the chick after hatching.

The effect of length of egg storage on hatchability and its relationship to age of breeder flock is illustrated by Figure 2. As noted, the hatchability curve changes with age of bird, indicating that eggs from young flocks can be held longer than eggs from older flocks without drastically affecting hatchability. Eggs from older flocks should be set as soon after lay as possible to obtain maximum hatching potential.

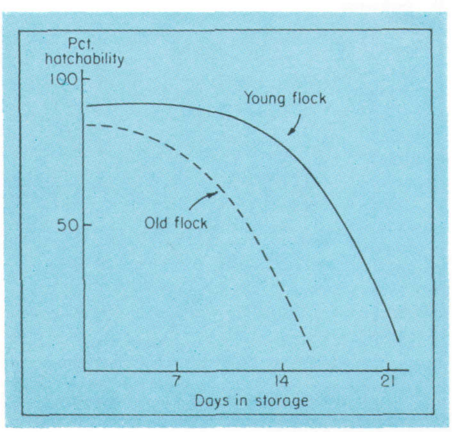

FIG. 2. Hatchability of young vs. old flocks in relationship to egg storage time.

Known physical changes occur in eggs during storage. One of these is weight loss due to moisture evaporating through the shell, and this is influenced by age of flock. The greater weight loss of eggs from older birds during storage is probably due to decline in shell quality. Correspondingly, there is a higher percentage of early embryonic mortality in eggs of poor shell quality. Moisture loss could be one cause of reduced hatchability of eggs from older flocks because of partial dehydration that may stress the embryo before incubation.

As the data indicate, length of storage of hatching eggs not only affects hatchability and chick quality, but also rate of gain of broilers. Since these are economic factors, the results suggest the need for proper egg handling on the farm and at the hatchery to ensure maximum hatching potential.

Cotton Planted in Close Rows More Competitive with Weeds

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FRED GLAZE, *Prattville Experiment Field*

WEEDS SEEM TO HAVE all the natural advantages for competing with crops. This seems especially true in cotton because cotton seedlings grow slowly in spring, particularly during cool weather. Therefore, weed control must be provided for a fairly long period after crop emergence.

Among the research efforts attempting to shift the competitive advantage from weeds to cotton is a new Alabama project involving the use of narrow-row planting. Any extra competitiveness that might result from narrow-row plantings could reduce the period during which weeds must be controlled.

Earlier research by Auburn University Agricultural Experiment Station had established that 6 to 9 weeks of control is required when cotton is planted in normal-width (38 to 42 in.) rows. It was further found that leaving stands of mixed annual weeds in the crop for more than 6 weeks would reduce cotton yields.

The new project compared different spaced rows to determine the influence on competitiveness of cotton with weeds during 1972-74 at the Prattville Experiment Field. The weed population consisted of a mixture of annual grass and broadleaf weeds.

In one set of experiments, cotton was maintained free of weeds for various periods after cotton emergence (called "weed-free periods"). In a second experiment, weeds were allowed to compete initially for various lengths of time after cotton emergence and then the cotton was kept weed free for the remainder of the season. These periods are referred to as "weeks of weed competition."

Conventional tillage was used in land preparation. Applications of N, P, and K were according to soil test recommendations. McNair 210 cotton was planted with toolbar-mounted unit planters, in 21-, 31-, and 42-in. rows. Enough seed were planted to give a final stand of 3 to 4 plants per ft. of row.

Each plot was 10.5 ft. by 20 ft., providing 6, 4, and 3 rows per plot, respectively, for the 21-, 31-, and 42-in. rows. All data were taken from the center row or two inner rows of each plot. Cotton was harvested by hand once each year.

With cotton kept weed free all season, yields were similar for all row spacings. As indicated by data in the table, however, production varied among row spacings with different weed-free periods. When cotton was maintained weed free for 2 or 4 weeks, cotton in 21-in. rows made more than that in the wider rows.

EFFECT OF DIFFERENT PERIODS OF WEED-FREE MAINTENANCE AT THREE ROW WIDTHS ON YIELD OF COTTON, PRATTVILLE EXPERIMENT FIELD, 1972-74

Weed-free period, weeks	Av. seed cotton yield/acre[1]		
	21-in. rows	31-in. rows	42-in. rows
	Lb.	*Lb.*	*Lb.*
0	75 d	109 f	21 g
2	1,070 b	566 e	482 f
4	2,016 b	1,374 d	1,115 e
6	2,453 a	1,980 c	1,722 d
8	2,480 a	2,168 bc	2,132 c
10	2,596 a	2,533 ab	2,373 bc
14	2,837 a	2,819 a	2,738 ab
Entire season	2,854 a	2,712 a	2,801 a

[1] Means within a column followed by the same letter are not statistically different ($P < .05$).

Cotton in 21-in. rows produced at a relatively high level with only 4 weeks of weed-free maintenance. This cotton reached a competitive stage after 4 to 6 weeks, when the canopy area provided enough ground cover to nullify subsequent competitive effects of emerging weeds. Weeds were able to compete longer in wider-spaced cotton.

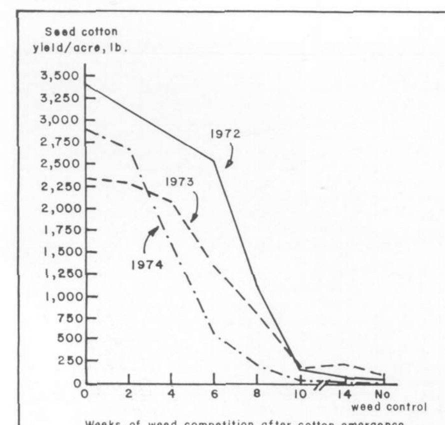
With the 21-in. rows, only 6 weeks of weed-free maintenance was required for cotton yields comparable to production with full-season control. Cotton in 31-in. rows required 8 to 10 weeks of control for similar results, and that in 42-in. rows required slightly longer periods of control.

When weeds emerged and became established with the cotton, removal of the weeds within 2 to 4 weeks prevented any competition damage to the crop. As shown by the graph, however, any longer competition by weeds reduced cotton yield. Width of row did not influence effects of weed competition.

During the critical initial weeks, both weeds and cotton plants were relatively small and about equal in height and competitiveness. Even in narrow rows, the distance between rows was so great that all rows were independent. Thus, competitive effects did not differ among row spacings during early growth stages.

It is not surprising that row spacing showed no effect on weed competition. Environmental conditions were conducive to the growth of both weeds and cotton. Regardless of row width, cotton could not obtain a competitive advantage because of the high population and rapid growth of weeds that germinated with the cotton. Furthermore, cotton grown in narrow rows under weed-free conditions has not shown a yield advantage over cotton in conventional-width rows.

Two major findings summarize the experiment: (1) row width did not influence the tolerance of cotton to initial weed competition, and (2) narrow rows (21-in.) reduced the critical weed-free requirement when compared with 31- or 42-in. rows.



Weeds that were not removed within 2-4 weeks after cotton emergence reduced yield.

SMALL SCALE FARMS IN ALABAMA

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Department of Agricultural Economics and Rural Sociology

Can They Survive?

THE NUMBER of farms in Alabama has changed from 257,000 averaging 68 acres to 72,000 farms of 188 acres during the 40-year period 1930-1970.

While the decrease in farm numbers was dramatic over this period, the statistics are misleading. A change in the census definition of farms occurred in the 1950 to 1960 counts. In 1930, farms included places of 3 acres or more having any agricultural production and places of less than 3 acres with production exceeding $250. By 1970 places of less than 10 acres were counted only if sales exceeded $250. Places over 10 acres required sales of $50 or more. As shown in Table 1 the steady decline in farm numbers from 1930 was accentuated in 1960 due to the change in definition.

Inflation has made comparisons of farm income over long periods of time relatively meaningless. Comparing only the two most recent census periods, 1960 and 1970, the major shifts occurred in the number of farms receiving less than $10,000 gross income. From 1960 to 1970 there were about 23 thousand fewer farms in the $10,000 and under group. This decrease and the decline in number of part-time farms essentially accounts for the total change in farm numbers between the two periods.

Small scale farms then might be defined by acreage or by income. In either case the number of small scale farms has and continues to decline in Alabama. The decline can be directly related to the increase in mechanization. Effective farm size for individual operators was limited so long as human or animal power was the principal input. With increased capital inputs, farm size becomes limited to a great extent by managerial ability. The farm becomes a business. If a farmer has 50 acres of land, all suitable for row crops, planting to soybeans results in a net income of about $2,500. If winter grain is added, net income might be increased to $4,000. The farmer's labor is underutilized and his income is well within the poverty level. The farmer also must own more equipment than is needed for 50 acres or be dependent on custom hire. Under these circumstances many small-scale operators have taken off-farm jobs.

TABLE 1. CHANGES IN FARMS IN ALABAMA 1930-1970

Year	Farm size (acres) 1-9	10-99	100 and over	Total	Av. acres per farm
	No. farms (000)				
1930	22	202	44	257	68
1940	13	168	51	232	83
1950	17	144	51	212	99
1960	8	70	38	116	143
1970	4	38	30	72	188

In spite of the trend toward increased mechanization and larger land acreage, there is a place for small scale farming. In fact small scale farming may be appropriate for certain specialized crops. Included among these specialty, labor-intensive crops are strawberries and bramble berries, staked tomatoes, sweet corn, okra, cucumbers, spring and fall greens, and various herbs. Some specialized livestock production also fits well on small scale units. Included among these animals would be goats, pigeons, ducks, and certain fishes if ponds are available.

TABLE 2. NET LABOR RETURNS TO SELECTED SMALL SCALE FARM ENTERPRISES

Crop	Labor required man hr./acre	Acres planted	Net returns per man hr.	Estimated total net return
			Dol.	*Dol.*
Tomatoes (staked)	800	0.5	5	2,000
Cucumbers (trellis)	800	0.5	5	2,000
Okra	100	1.0	5	500
Sweet corn	32	5.0	10	1,600
Melons	32	5.0	10	1,600
Strawberries	160	0.5	10	800
Bramble berries	160	0.5	10	800
Total labor	1,380 (total hr.)			9,300

In every case the small scale farmer must make maximum use of his own labor. By hand or animal cultivation, crop spacings can be reduced and yields per acre increased. Crops can be harvested at the peak of maturity and market periods can be prolonged. Cucumbers, for example, can be grown on trellises for more uniform fruit development and less space requirements. The net returns to labor from 1/10 acre of cucumbers exceed the returns from an acre of soybeans.

An example of enterprises for a small scale farmer could include a ½ acre bed of strawberries, ½ acre of blue or blackberries, a small family orchard of apples and peaches, two dairy cows, 50 chickens, one sow, 4 acres of pasture, sufficient field corn and hay for the livestock enterprises, and non-labor competitive vegetable enterprises for cash income. A degree of self sufficiency is desired to reduce cash off-farm expenditures, however, the main goal is concentration on enterprises with high returns to labor and minimum inputs of capital.

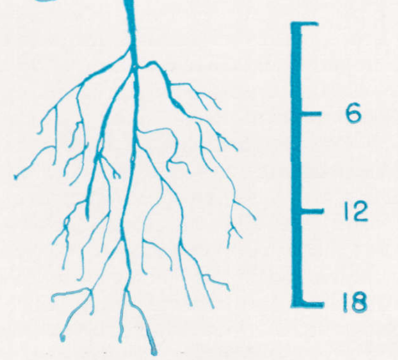
The berries and fruit are long lived while all of the livestock provide their own replacements plus surplus for home use and sale. If, for example, the cash crops were berries, sweet corn, cucumbers, okra, staked tomatoes, and melons and the farmer was willing to put in 200 hours of labor per month from April to November, his income would be comparable to most factory jobs in Alabama. The berries would require about 160 hours of labor with a concentration during the bearing season. The returns per hour of labor could exceed $10.

The returns per hour for sweet corn and melons would be comparable to berries while tomatoes and cucumbers would net about $5 per hour of labor. Both tomatoes and cucumbers require about 800 hours of labor over the growing season with a concentration during the staking or trellising stage. Okra has a long bearing period and requires frequent harvest. The returns per hour are equal to tomatoes and cucumbers but labor requirements are much lower.

Looking at the small scale farm from a labor budget point of view, and considering growth requirements of each crop, the net returns from the market garden would be about $9,300 or over $6 per hour for labor.

The key to success for the small scale farmer is to accentuate the advantages of smallness. Specialize in production that does not lend itself to mechanization. Become self-sufficient in production and reduce cash input expenditures. Some product gap of quality and freshness has been created by large scale farming. Small scale farmers should exploit this gap and create income opportunities to enhance their level of living.

Correction Of Subsoil Acidity In Cotton Production On Coastal Plain Soils



W. T. DUMAS, *Department of Agricultural Engineering*
B. D. DOSS, *Cooperative, USDA*

THE COASTAL PLAIN areas of the southern United States typically have acid subsoils. Work at Auburn University's Agricultural Experiment Station has clearly shown that strongly acid subsoils can drastically reduce cotton yields from those obtained on the same soil where critical subsoil acidity due to the use of residually acid fertilizer has been avoided. However, there has been little or no crop yield response reported for lime incorporation to depths below the plow layer in field experiments.

Studies were initiated in 1974 to evaluate the depth of incorporation of lime required for satisfactory cotton root system development and plant growth on acid soil profiles. The experiment was located at the Agricultural Engineering Research Unit in Marvyn, and consisted of 20 plots, each 26⅔ ft. by 75 ft., on a Norfolk sandy loam soil, with four replications of five treatments. The treatments were depth of lime incorporation as follows:

1. Check (no lime)
2. Lime incorporated to 6-in. soil depth (0-6)
3. Lime incorporated to 12-in. soil depth (0-12)
4. Lime incorporated to 12-in. soil depth (after turning with moldboard plow 16-18 in. deep) (0-12) (T)
5. Lime incorporated to 18-in. soil depth (0-18)

Treatments were imposed in early spring of 1974 after the soil profile pH was reduced to 4.6-4.8 by application of ammonium sulfate during 1973. The rate of lime needed to raise pH in the treated zone to at least 6.0 was determined by soil test. All plots were initially chiseled to a depth of 18 in. to reduce physical differences resulting from subsequent lime incorporation. Lime was applied to the surface and incorporated to 6-in. and 12-in. soil depths with a rotary tiller. The 18-in. depth of incorporation was accomplished in three steps. (1) apply lime and incorporate into the 0-9 in. soil depth with a rotary tiller. (2) turn with a moldboard plow to a depth of 18 in. (3) apply lime and incorporate 0-9 in. with a rotary tiller.

Soil pH determinations before and after treatments were imposed and are given in Table 1. The pH in the soil profile ranged from 4.6 to 4.8 before treatments were imposed. The pH values for December 1975 samples indicate that lime may not have been incorporated as deeply as desired on the 0-18 in. treatment.

Plant height measurements made during the growing season show that rate of plant growth was greater on lime-incorporated plots than on no-lime plots. The main difference in final plant heights at the end of the growing season was between no-lime and lime-incorporated plots with little difference in plant heights due to depth of lime incorporation. Final plant heights averaged 28 in. for no-lime plots and 47 to 54 in. for lime-incorporated plots.

Seed cotton yield was increased by lime incorporation (Table 2). Yields were higher for plots with 12 in. or greater incorporation than on plots with 6 in. incorporation. Data for 1974 and 1975 indicate that lime incorporation to 12 in. would be beneficial. Yield responses for lime incorporation below 12 in. were not consistently beneficial. The extra expense of deep incorporation is probably not justifiable.

TABLE 1. SOIL pH

Date	Treatment	pH by soil depth in in.			
		0-6	6-12	12-18	18-24
1/23/74	Test area (before treatments imposed)	4.8	4.6	4.7	4.8
12/15/75	No lime	4.7	4.7	4.8	4.9
	0-6	5.9	5.1	4.8	4.9
	0-12	6.4	5.4	4.9	4.3
	0-12(T)	6.4	5.8	4.9	4.9
	0-18	6.9	6.5	5.1	4.8

TABLE 2. YIELDS OF SEED COTTON

Treatment	Pounds of seed cotton per acre		
	1974	1975	Av.
No lime	885	805	845
0-6	1,688	2,127	1,908
0-12	1,999	2,302	2,151
0-12(T)	2,092	2,267	2,180
0-18	2,139	2,311	2,225

Chemically Suppressing Grass Sod Helps Overseeded Winter Annuals

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Lower Coastal Plain Substation

WITH DORMANT SEASONS lasting 5-7 months, bahiagrass and bermudagrass sods are unproductive about half of each year. That's why many cattlemen overseed these grass pastures with rye or mixtures of rye, ryegrass, and arrowleaf clovers. Not only does the overseeding extend the grazing season, it also improves quality of forage produced.

Amount of added grazing time is limited because seeding is generally delayed until October or November when the grass is dormant. Otherwise, the grass provides too much competition with the new seedlings for soil moisture.

Application of a chemical growth suppressant to the grass sod in September should permit earlier planting and, therefore, earlier grazing. This method has been investigated in Auburn University Agricultural Experiment Station tests in recent years.

At the Lower Coastal Plain Substation, Roundup®[1] (common name glyphosate) was tried over a 3-year period (1973-75) on grass sod. Application at planting in September effectively suppressed bahiagrass sod and doubled the November-February rye forage yield. On Coastal bermuda, however, Roundup gave only a small increase in rye yield.

Using Paraquat®[2] was generally ineffective for suppressing growth of grass. It did not increase yield of rye forage.

How Herbicides Used

Pensacola bahia and Coastal bermuda sods were sprayed with different rates of Roundup and Paraquat in mid-September during each of the 3 test years. Wrens Abruzzi rye was seeded at 50 lb. per acre with a Zip Seeder the first year and with a grassland drill the next 2 years. Gulf ryegrass was broadcast at 15 lb. seed per acre and Yuchi arrowleaf clover at 5 lb. Nitrogen applications of 75 lb. per acre were made at planting and in February, April, June, and July. Forage was harvested when available from November to September or October.

Paraquat gave rapid top kill of bahia and bermuda. After several weeks, however, new growth began and continued until frost, competing with new seedlings for soil water. Top kill from Roundup was slower, but longer lasting, than from Paraquat.

[1] Roundup is a product of Monsanto Chemical Co.
[2] Paraquat is a product of Chevron Chemical Co.

Winter Forage Production

Total winter forage production by rye-ryegrass-arrowleaf clover ranged between 4,000 and 6,000 lb. per acre and was not affected by sod treatments. However, applying Roundup to bahiagrass doubled the production of forage in autumn and early winter (November-February), Table 1. Forage produced at this time was mostly rye. A Roundup rate of ¼ lb. active ingredient per acre was as effective as higher rates. Paraquat gave contrasting results, showing little or no effect on rye forage production.

Spring production of clover was generally better on Roundup-treated bahia sod. Neither Paraquat nor Roundup had much effect on rye seeded on bermudagrass sod.

Bahia Sod Damaged

Although Roundup increased November-February rye yields on bahia, it damaged the sod and decreased forage production the following summer, Table 2. Even ¼ lb. per acre Roundup applied in September decreased June-July bahiagrass forage yields. Some of this yield reduction may be a result of shading by the heavy spring growth of ryegrass and clover. Since winter annual forages are high quality and grow when pasture is badly needed, they are more valuable than extra bahiagrass in summer. Roundup damage to bermudagrass was much less than to bahiagrass sod.

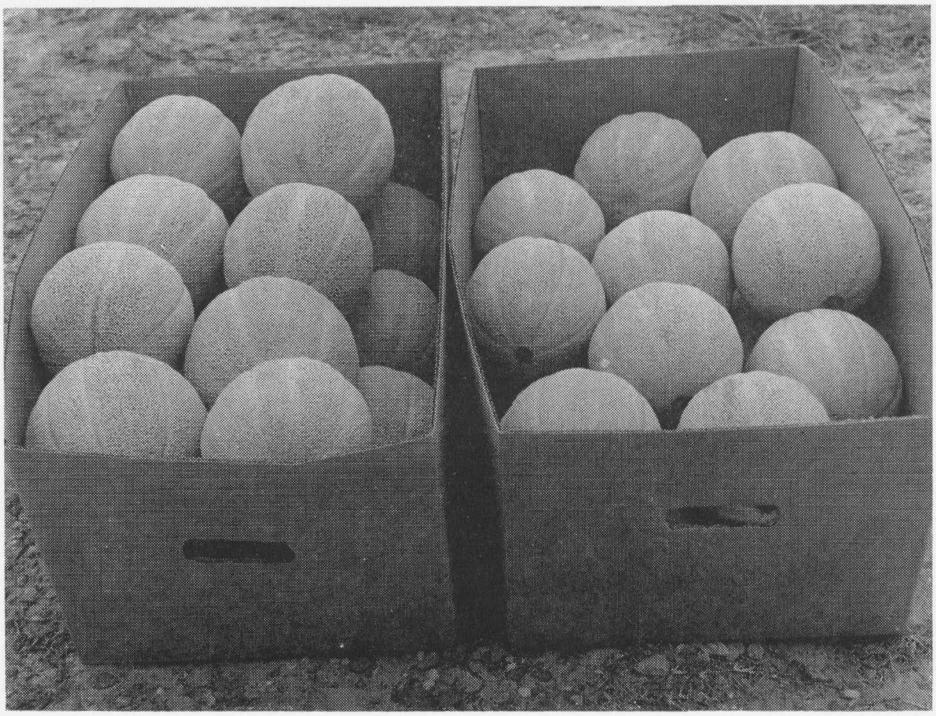
Sod-seeding winter annuals on bahia sod is less dependable than on prepared land. Forage yields are much lower on sod than on prepared land, probably because of competition for soil moisture in autumn, more nematodes, more diseases, and more insects. Paraquat did not adequately suppress bahiagrass or bermudagrass sod to improve rye forage production. Roundup, *which is not yet labeled for use on pastures*, doubled the November to February production of rye on bahia sod but had little effect on bermuda sod.

TABLE 1. NOVEMBER-FEBRUARY RYE FORAGE PRODUCTION AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON BAHIA SOD, LOWER COASTAL PLAIN SUBSTATION, 1973-76

Sod treatment/acre	Dry forage yield per acre		
	1973-74	1974-75	1975-76
	Lb.	*Lb.*	*Lb.*
Check, not seeded	0	0	0
Check, seeded	150	550	880
Paraquat, ¼ lb.	180	640	710
Paraquat, ½ lb.	150	800	570
Roundup, ¼ lb.	-----	1,150	1,440
Roundup, ½ lb.	-----	1,270	1,470
Roundup, 1 lb.	-----	1,390	1,470
Roundup, 2 lb.	1,500	1,640	1,680

TABLE 2. SUMMER BAHIAGRASS FORAGE PRODUCTION AS AFFECTED BY AUTUMN-APPLIED GROWTH SUPPRESSANT CHEMICALS, LOWER COASTAL PLAIN SUBSTATION, 1974-75 SEASON

Sod treatment/acre	Dry forage yield per acre			
	July 9	Aug. 13	Oct. 9	Total
	Lb.	*Lb.*	*Lb.*	*Lb.*
Check, not seeded	3,960	2,470	2,000	8,430
Check, seeded	3,680	2,140	2,450	8,270
Paraquat, ¼ lb.	3,300	2,450	2,420	8,170
Paraquat, ½ lb.	3,440	2,320	2,520	8,280
Roundup, ¼ lb.	2,500	2,000	2,300	6,800
Roundup, ½ lb.	1,930	1,960	2,380	6,270
Roundup, 1 lb.	1,340	1,760	2,230	5,330
Roundup, 2 lb.	820	1,550	2,360	4,730



Auburn developed cantaloupe varieties produce melons suited for packing in boxes.

New Cantaloupes Suited for Commercial Production

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C. C. CARLTON and K. C. SHORT, *Chilton Area Horticulture Substation*
J. E. BARRETT, *Gulf Coast Substation*
M. H. HOLLINGSWORTH, *North Alabama Horticulture Substation*
C. A. BROGDON, *Wiregrass Substation*

CANTALOUPE VARIETIES suited for commercial production in Alabama are now available. Three varieties developed at Auburn University Agricultural Experiment Station proved their worth in plantings at five locations.

Chilton and Gulf Coast, two of the Auburn releases, proved to be most adapted for packing in boxes. The third one, Southland, was among the varieties suited for hauling loose in trucks. The three were compared with four standard varieties in the tests at the Main Station, at Auburn, Chilton Area Horticulture Substation, Clanton, North Alabama Horticulture Substation, Cullman, Wiregrass Substation, Headland, and Gulf Coast Substation, Fairhope.

Description of Test

Seed were planted in hills 4 ft. apart, in rows spaced 5 ft. apart. Fertilizer was applied according to soil test recommendations. An additional application of 100 lb. of ammonium nitrate per acre was applied at locations where there was excessive rainfall during the early growing season. Plantings were made at the proper date for each location.

Each planting was harvested five times at 3-day intervals at the full slip stage. Yield was recorded by number and weight of marketable fruit for each harvest. Disease resistance was evaluated using a plant injury rating from 0 to 5 on a disease index scale. Fruit weight, length, diameter, thickness of rind and flesh, diameter of cavity, total soluble solids, taste, and color were recorded for eight melons of each variety from each harvest.

Variety Comparisons

Varieties that gave the highest yield were Chilton, Gulf Coast, and Southland. Planters Jumbo was intermediate, and Edisto, Gulfstream, and Hales Best Jumbo produced lowest yields.

The edible quality of the fruit was determined using total soluble solids and taste as measures. Chilton and Gulf Coast rated highest. Quality was also good for Edisto, Gulfstream, Planters Jumbo, and Southland. Hales Best Jumbo was unsatisfactory in edible quality.

Chilton, Gulf Coast, Gulfstream, Hales Best Jumbo, and Southland were earliest of the test varieties. They were ready for the first harvest at 75 days after planting. Planters Jumbo required 80 days and Edisto 85 days to mature.

A multiple disease resistance to downy mildew, powdery mildew, and gummy stem blight was observed in Chilton, Gulf Coast, and Southland varieties. Good levels of resistance were present in Edisto, Gulfstream, and Planters Jumbo, except they were damaged by gummy stem blight.

Chilton and Gulf Coast melons have suitable size and firmness for packing in boxes or crates for commercial markets. Southland, Edisto, and Planters Jumbo are large fruited varieties suitable for loose hauling and local sales. Hales Best Jumbo fruit are too soft at maturity for handling in harvesting and marketing.

YIELDS OF CANTALOUPE FRUIT AT FIVE ALABAMA LOCATIONS, AND AVERAGE YIELD, FRUIT WEIGHT, AND SOLUBLE SOLIDS CONTENT, 1967-73

Variety	Per acre yield, by location					Average, 5 locations		
	Auburn	Clanton	Fairhope	Cullman	Headland	Yield	Fruit weight	Soluble solids
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*
Chilton	9,895	17,272	30,729	17,594	14,113	17,921	2.62	12.20
Gulf Coast	14,059	14,440	22,303	12,545	21,188	16,908	2.87	11.62
Southland	11,195	17,566	23,564	14,556	12,813	15,939	3.16	10.94
Planters Jumbo	6,756	13,384	22,891	12,480	15,192	15,730	3.27	10.19
Edisto	5,173	9,418	20,247	9,836	9,254	12,375	3.20	10.46
Hales Best Jumbo	13,098	15,420	19,193	18,130	10,047	13,501	3.02	6.12
Gulfstream	11,160	11,378	17,884	15,490	6,780	11,341	2.35	10.11

FOLLOWING FISHES BY SOUND

WILLIAM L. SHELTON, *Alabama Cooperative Fisheries Research Unit*

A VARIETY of methods has been used to study the movements of fishes, but perhaps one of the more unusual (and certainly one of the most useful) is currently being used by Auburn University researchers. Fishes are being followed by sound; not that produced by the fish, but by an object they are carrying. The energy is generated by a self-contained transmitter which is attached to the animal, or surgically implanted in it. The sound waves (74 khz), which are in the ultrasonic range, are detected with an underwater microphone and translated to audible sound by a receiver.

A variety of messages can be received from the transmission, the most basic of which is the fish's location. Variation in frequency, pulse-rate, or both permits the researcher to identify several individuals. Size of the transmitter is inversely related to reception range and longevity. Larger batteries permit greater range and longer transmission life. Range is also affected by water conditions. Suspended material, or a sharp temperature gradient, diminishes the range. Solid objects such as stumps completely block the signal. Under optimum conditions signals can be received at distances up to a mile. Most transmitters have a useful life of 1 or 2 months, but some now on the market function continuously for nearly a full year and are still small enough to be easily carried by a 3-lb. bass.

The design of the transmitter determines the information that can be obtained. Some transmitters incorporate a thermistor and relay the temperature of the fish or of surrounding water; others have a pressure-sensitive element that relays the depth at which a fish is swimming; others provide remote sensing of certain vital signs, such as heartbeat or respiration rate. Such data from free-swimming individuals permit biologists to correlate behavior with possible controlling or at least influencing factors. Thus a comparison might be made of movements with variation in daily light intensity, temperature, or climatological factors.

Relatively few fishes can be simultaneously tagged because frequency or pulse-rates overlap and because of the expense, as much as $250 each for transmitters.

Personnel of the Department of Fisheries and Allied Aquacultures in Auburn University's Agricultural Experiment Station have completed basic studies of fish movements in ponds and have applied this experience to investigations in thermally influenced areas in an Alabama river. Largemouth bass, channel catfish, and flathead catfish have been tagged successfully.

Objectives have been attained that could not have been achieved using more conventional methods. Movement of fishes has commonly been studied by applying a tag or other identifiable mark which indicates the fish's release and recapture sites. Obviously, the minimum distance between release and recapture sites can be determined, but not the route and actual distance moved. But with sonic tagging, the horizontal progress, and in many instances vertical displacement, can be monitored continuously. Sonic tagging studies of the largemouth bass in West Point Reservoir which will broaden the scope of the current studies (see Highlights, Vol. 23, No. 2, Summer, 1976), and provide a much more thorough understanding of bass behavior, are now being planned.

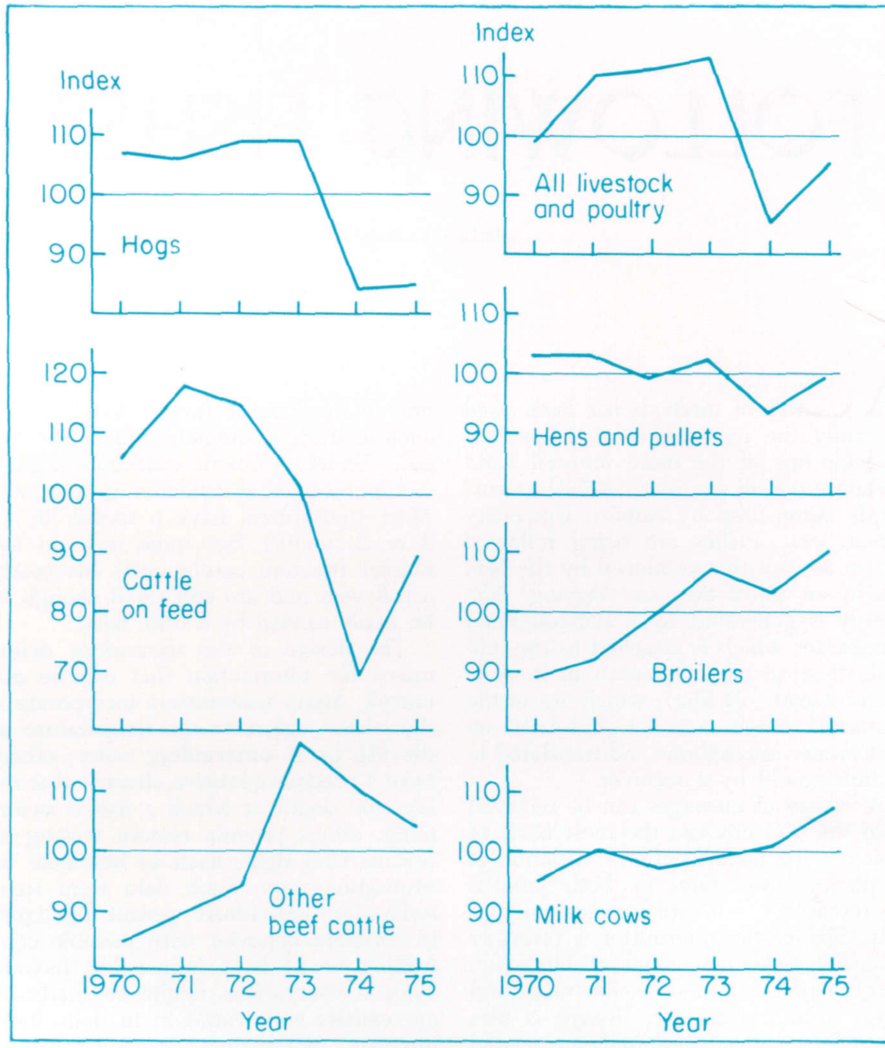
[1] Supported by the U.S. Fish and Wildlife Service, the Game and Fish Division of the Alabama Department of Conservation and Natural Resources, and the Department of Fisheries and Allied Aquacultures.

This transmitter shown left with a thermostatic probe has a self-contained power supply; total weight in water is only 15 g. Calibrations of the scale are in millimeters. The transmitter has been surgically implanted shown center in this anesthetized 4-lb. largemouth bass. Location of the tagged fish and water temperature can be determined for 4-8 weeks from a distance up to 1 mile. The signal is picked up by a rotatable hydrophone shown right and passed to a receiver which presents the signal aurally and visually.

Concentrate Feeds- Domestic Consumption or Export?

MORRIS WHITE

Department of Agricultural Economics and Rural Sociology



Index of concentrate feed fed in the United States, 1970-1975 (5-year av. = 100).

IMPORTANT DEVELOPMENTS that influence the use of concentrate feeds in the United States have taken place since 1970.

Examples are the tremendous increase in exports of grains and protein feeds, and the relative importance those exports have taken on in the National balance of payments. Expressions of concern about world population growth putting pressure on human food supplies are receiving more attention than in the past, which raises the question, can we afford to continue feeding concentrates to livestock?

Use of Concentrates in Feeds

Use of concentrates in livestock and poultry feeds has been increasing over a period of years in the United States. This is a reflection of consumers' desires for greater quantities of grain-fed red meats and poultry. Per-capita consumption of red meat was 21 lb. greater in 1974 than in 1965, and consumption of poultry rose 9 lb. Although consumption of pork was 8 lb. greater in 1974 than in 1965, the rise was not as consistent as with beef and poultry.

Producers of livestock and poultry products in the United States fed an average of 463.2 million tons of harvested feed annually during the period 1970-1975. Approximately 40% was concentrates, and the remainder was hay and other harvested forages. The annual average tonnage of concentrates was 184.7 million, which was 80% feed grains and 20% high protein and other byproduct feeds.

Corn was the principal ingredient of concentrates. It comprised three-fifths of all concentrate feeds and three-fourths of the feed grains. Grain sorghum made up 9 and 12% of concentrates and feed grains, respectively.

The upward trend in volume of concentrates fed reached a peak of 200.4 million tons in 1973. The trend was interrupted in 1974 by a combination of events. Two primary reasons were: depletion of grain inventories as a result of greatly expanded exports during 3 previous years, and a drop of 17% in the United States corn crop in 1974. Resulting grain price increases in combination with lower beef cattle prices contributed to a 22% drop in volume of concentrates fed in 1974. All major types of livestock and poultry, except milk cows, were fed less concentrate in 1974 (see figure).

Concentrate Consumption

During the 1974-75 period, beef cattle (those on feed and other beef cattle) were fed the most concentrates. They consumed 29% of the total. Separately, hogs consumed the most, 26%. Milk cows and hens and pullets consumed 14 and 10%, respectively. Broilers, which comprised approximately 17% of the combined per-capita consumption of beef, pork, and chicken, were fed approximately 7% of the concentrates. The kind of livestock that was fed the least amount of concentrate was sheep.

Conditions that favor the feeding of concentrates greatly improved in 1975 over what they were in 1974. This was mainly the result of 24% increase in corn production. Volume of concentrates fed increased 10%, yet it remained 12% below the peak reached in 1973.

Exports a Major Factor

Exports and the need for exporting grain to improve the Nation's trade balance will be a major factor affecting the volume of concentrates fed in the United States. In 1967, 13% of the production was exported; it is estimated that 28% (1.6 billion bu.) of the 1975 crop will be exported. If reductions in volumes of concentrates fed become necessary, cuts will be made first in the quantities fed to beef cattle and next in that fed to hogs.

THE EXTENT OF UNCOLLECTABLE EGGS DUE TO INADEQUATE SHELLS

DAVID A. ROLAND, *Department of Poultry Science*

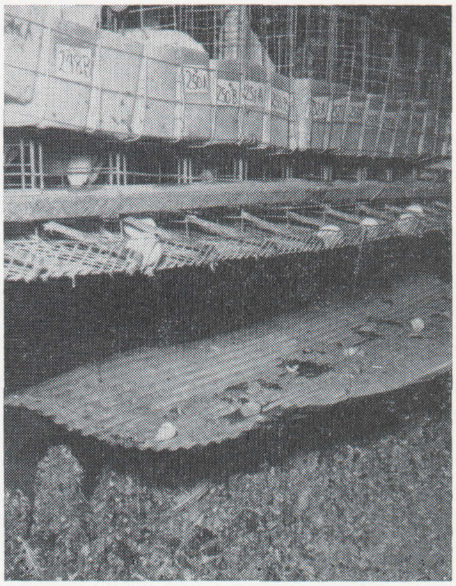
IT IS ESTIMATED that 6.37% of all eggs are lost due to inferior eggshells, making poor shell quality the number one problem of Alabama egg producers. Results of recent studies, however, indicate that 7.78% of all eggs from commercial-type leghorns are not collected or recorded as eggs produced. This represents an additional 9.5 million dollar loss by Alabama egg producers, making the problem much more severe than previously estimated. Without special techniques of collection, most uncollectable eggs are absorbed by manure and are not visible to the producer. Although extensive research is being conducted to determine the cause of uncollectable eggs, the solution is still not known. However, it is certain that the condition is not caused by hens consuming inadequate calcium and that increasing the calcium level of the diet will not correct the shell-less egg problem.

A study at Auburn University's Agricultural Experiment Station was designed to determine the extent and cause of uncollectable eggs in a typical commercial-type egg operation. To do this Auburn scientists observed 4.8% of approximately 140,000 birds of different ages during summer and winter months.

Results

The results indicated that some uncollectable eggs are laid by pullets first coming into production and the incidence increases with age (tables 1 and 2). During the winter, the percent of uncollectable eggs increased as the hen aged, with a low of 2.39% from birds 8 months of age, to 14.74% from birds 17 months of age. The percentages were obtained by dividing the number of collectable eggs by the number of uncollectable eggs. The incidence of each individual class of uncollectable eggs in general, increased as the age of the hen increased. Comparable data for the summer were 2.86% and 16.11%, respectively. This indicated that temperature or season had little influence on the incidence of uncollectable eggs.

It is believed that the incidence of uncollectable eggs is not peculiar to one strain, therefore, two strains were observed. At 17 months of age one strain laid 6.26 uncollectable eggs per 100 birds, while the other laid 6.53. Shell-less eggs in quail, turkeys, and pheasants have also been observed, suggesting that this problem is common in other avian species.



The figure shows method of observing uncollectable eggs. Eggs which fall through cage because of poor shell quality represent 7.78% of all eggs collected from commercial-type leghorns.

TABLE 1. UNCOLLECTABLE EGGS PER 100 HARD-SHELL EGGS (WINTER)

Type eggs	Age of hen (months)			
	8	11	14	17
Shell-less	1.83	2.90	3.27	8.82
Ultra-thin shell	0.56	1.37	4.91	3.27
Thin-shell	0.00	0.85	2.45	0.65
Total	2.39	5.12	10.63	14.74

TABLE 2. UNCOLLECTABLE EGGS PER 100 HARD-SHELL EGGS (SUMMER)

Type egg	Age of hen (months)			
	8	11	14	17
Shell-less	2.41	1.99	4.31	7.50
Ultra-thin shell	0.45	1.39	2.25	7.73
Thin-shell	0.00	0.20	0.19	0.88
Total	2.86	3.58	6.75	16.11

Although the production of shell-less eggs was reported as early as 1899 by Hargitt, few researchers have studied the cause of shell-less egg production.

Past research by the author indicates that the cause of most uncollectable eggs is not due to premature expulsion. Most uncollectable eggs are laid at daily intervals or longer. For example, a bird would lay an abnormal egg on day one at 6 a.m., day two at 11 a.m., day three at noon, and day four at 3 p.m. Palpation of the uterus at night and sacrificing the hens the next day indicated that many shell-less eggs were staying in the uterus the normal length of time.

Conclusions

The results of these studies demonstrate clearly that uncollectable eggs represent a tremendous loss to the commercial egg producer. Although extensive studies are being conducted at Auburn University to solve this problem, the solution is still not known. It is certain, however, that shell-less eggs are not due to the hens inability to absorb calcium, get calcium into the blood, bones, or to the uterus but due to their inability to utilize calcium in the actual process of shell calcification. There is no recommendation that can be offered at the present time to prevent or correct the shell-less egg condition.

Methods to Evaluate Investments in Alternative Farm Enterprises

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Department of Agricultural Economics and Rural Sociology

CHANGES in agricultural research, technology, product demands, and input costs can cause a change in the order of the relative profitability of farm enterprises. The increased energy cost, for example, has increased the feasibility of minimum tillage practices even though output is reduced. While producers operate in the uncertainty of short run market forces, most of their investment decisions are of a long term basis. When purchasing land, equipment, or buildings the producers must estimate enterprise returns over the life of the asset.

Several methods of evaluating investment decisions are used in farm planning. One of the more common is the enterprise budget. In an enterprise budget the expected costs and returns from a "normal" production period are estimated. Returns are usually conservative while input prices are higher than expected. The investment capital is averaged and roughly corresponds to the value of the non-depreciable capital plus half the value of the depreciable capital. The returns to average capital investment can be used as a rough gauge in appraising capital investment in alternative enterprises. Unfortunately the enterprise budget represents the situation after the production process has started and does not directly consider start up costs and flow of income over time.

A method to improve the usefulness of the enterprise budget for management decisions is by cash flow budgeting. Rather than a static picture of income and expenses at the end of the productive period, the incidence of payment is included. The nature of most agricultural production is more clearly revealed in a cash flow analysis. Cash input payments extend through the growing season while cash receipts are concentrated at harvest.

Cash flow analysis will often allow a producer to reduce costs of borrowing. In some instances cash flow analysis will cause rejection of some enterprises that clearly appear profitable with budget analysis. The spacing of cash receipts simply is not compatible with repayment of borrowed capital and would reduce family living expenses to an unacceptable level. An example could be conversion of crop lands into ponds for fish production. In the short run the land would be nonproductive while pond construction was carried out. Over several years fish production would be reduced while the ponds aged and became stabilized. In the long run, income would be increased, though the producer would have increased fixed payments. Neither budget analysis nor cash flow allows adequate consideration of this type of enterprise.

A method to evaluate an enterprise in terms of when investment costs are incurred and the flow of cash income is called internal rate of return analysis. As the name implies, the procedure is used to evaluate investments in productive enterprises and to compare these investments with the rate of return from banks, savings, and other sources. In general, cash in the present has a higher value than the promise of cash in the future. The difference between present and future value is measured by the rate of interest. When a producer purchases land, equipment, or other capital items the cost is computed in present dollars. If money is borrowed for the purchase the future dollars are converted to present value by inclusion of an interest rate.

In budget analysis the present value concept of capital investment items is recognized by inclusion of interest as a cost; however, the returns are not treated in the same fashion. With a yearly rate of inflation of 7%, $100 returns expected in 12 months have a present value of only $93.45. The same returns 10 years from now are valued at only $50.83. Over the 10-year period the present value of $100 returns per year would be $702.36.

To determine the internal rate of return from an enterprise, the interest rate which will equate the flow of net returns and the investment cost over the life of the investment is determined. In the example, the 7% rate was too high for a $1,000 asset with a 10-year life. The enterprise appears profitable from budget analysis; net returns are positive and returns to average capital exceed 16%. The cash flow is skewed towards the harvest season as with many agricultural enterprises. Capital investment divided by net returns equals 10, which is the life of the asset. The internal rate of return equals zero and if the inflation rate continues at 7% the investment will lose about $300 in present value over the time period.

The combination of evaluation techniques is needed to properly appraise enterprises in the farm plan. In the short run the enterprise must not require cash expenses sufficient to reduce family expenditures to an unacceptable level. In the intermediate period the enterprise must have positive net returns and over the life of the investments it must generate internal capital to equate future returns with present value of cost items.

Budget		Cash flow	*Expenses**	*Receipts*
Capital	$1,000			
Average capital	600	March	$150	
Total returns	600	June	150	
Total cost	500	Aug.	100	600
Net returns	100	Total	400	600
Pct. return to av. capital	16	Net cash		200

* Excludes depreciation.

PINE STRAW MULCH INCREASES WEEDS IN FOREST TREE NURSERIES

DAVID SOUTH, *Department of Forestry*

MORE THAN one-third of the state owned forest nurseries in the Southeast use pine straw as a mulch for seedbeds since it provides excellent protection against moisture loss, bed erosion, and extreme heat. A disadvantage of pine straw mulch is that weed populations may be increased due to introduction of weed seed.

Soil fumigation with methyl bromide is presently a common weed control practice in nurseries. After treatment, soil is relatively sterile and provides an excellent growing medium for any seed: tree or weed. At one nursery in North Carolina, over $500 an acre was spent for methyl bromide fumigation. Experimental plots were then either mulched with pine straw or left unmulched (see figure). The pine straw introduced many weed seed, resulting in the necessity for handweeding that cost $520 per acre. The unmulched plots required only $40 per acre for handweeding. The value of soil fumigation for weed control was lost when the mulch infested with weed seed was used.

The Forest Nursery Weed Control Project, a cooperative of the Auburn University Agricultural Experiment Station, has directed research toward alternative methods of weed control. In 1976, experiments involving fumigated and unfumigated pine straw mulch on fumigated and unfumigated nursery soil were carried out at two Alabama nurseries. Methyl bromide was applied to plastic covered mulch piles at the rate of 1 lb. per 20 cu. ft. After 48 hours the plastic was removed and the mulch piles were allowed to air. Half the experimental plots were fumigated at the rate of 1 lb. of methyl bromide per 100 sq. ft. of soil surface.

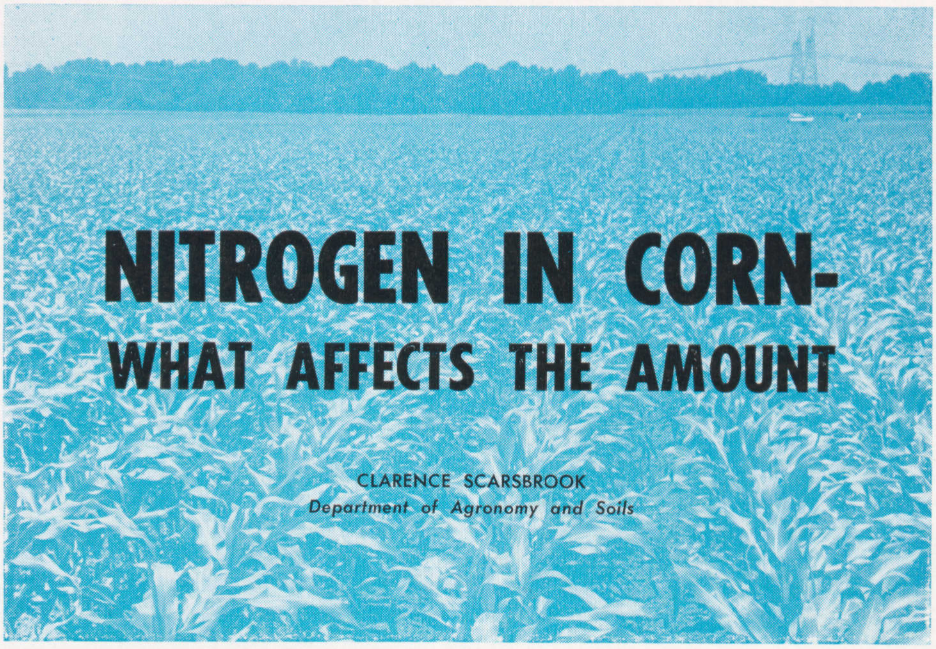
At nursery B, fumigating mulch reduced weeding times by 58% (see table). Fumigating soil resulted in only a 28% reduction in weeding time. Therefore it appears that, at this location, the majority of weed seeds were not soil borne, but were introduced in the pine straw mulch. At nursery A, fumigating mulch was as effective in controlling weeds as soil fumigation, but soil fumigation costs approximately $450 more per acre than mulch fumigation. When soil fumigation was used, weeding times were 38% greater for unfumigated mulched plots than they were on fumigated mulched plots at nursery A and more than 100% greater at nursery B. At these nurseries, mulch fumigation did as well or better than soil fumigation in controlling weeds.

These studies show that pine straw mulch can be a major source of introduced weeds in forest nurseries. Soil fumigation with methyl bromide is a common but expensive method of controlling weeds. The value obtained from soil fumigation can be lost if weed infested mulches are used. To prevent increased weeding, either straw mulches should be fumigated or weed-free mulches should be used.

HANDWEEDING TIMES FOR DIFFERENT MULCH TREATMENTS AT NURSERIES A AND B IN ALABAMA, IN 1976

Treatment	Handweeding times	
	Nursery A	Nursery B
Unfumigated soil	*Hours per acre*	
Unfumigated mulch	53.0	80.4
Fumigated mulch	38.7	33.7
Fumigated soil		
Unfumigated mulch	40.4	57.5
Fumigated mulch	30.8	28.3

The pine straw mulched plot in the center required the equivalent of 200 more man-hours of weeding time per acre than the unmulched plots on the right.



NITROGEN IN CORN-
WHAT AFFECTS THE AMOUNT

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NITROGEN is essential for the production of protein in crops. This protein is an important measure of feed value in corn grain and stover.

Young corn plants, under favorable growing conditions, often contain as much as 5% nitrogen. With favorable growing conditions, this nitrogen will be transported to grain and utilized in protein production. After grain has been produced, vegetative parts usually contain between ½ and 1% nitrogen.

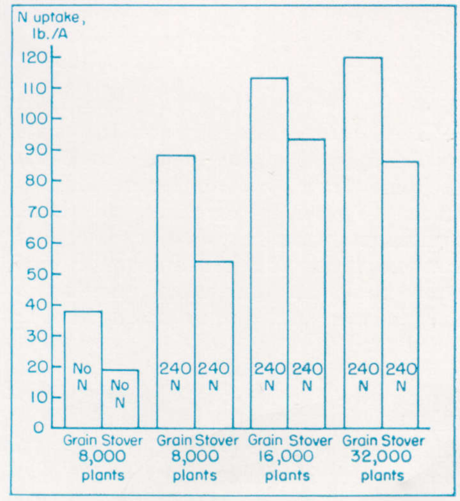
If insect infestation, disease, or drought are severe, little or no grain may be produced. Under such conditions, most of the plant's nitrogen will not be used for grain protein production. Nitrogen as nitrate may reach such a height under severe drought conditions that vegetative parts are toxic to ruminant animals.

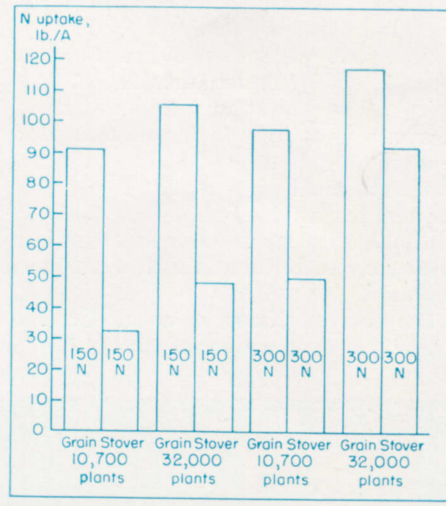
The amount of nitrogen available in the root zone and the number of plants per unit area have an important effect on the nitrogen content of both grain and stover, (see figure). With 8,000 plants per acre and no applied nitrogen, the total crop contained only 60 lb. nitrogen. When the same number of plants were grown and received 240 lb. of nitrogen applied per acre, the grain and stover yields were about doubled and the total crop contained around 140 lb. nitrogen.

For efficient corn production 8,000 plants per acre is too thin a stand. With a 16,000-plant population and 240-lb. rate of nitrogen, the grain yield was 120 bu. and the total crop contained over 200 lb. nitrogen. Higher plant populations only slightly increased the yield of nitrogen uptake.

It takes high plant populations to efficiently use high rates of nitrogen, (see figure). When 150 lb. of nitrogen was applied, about one-fourth more nitrogen was contained in the crop with 32,000 than with 10,700 plants per acre. With 300 lb. of nitrogen, but only 10,700 plants, about the same nitrogen uptake was measured as with 150 lb. of nitrogen and a 32,000-plant population. An even higher nitrogen uptake was observed where the high rate of nitrogen was combined with the high plant population. Grain and stover yields showed similar trends to nitrogen uptake values.

These data show that adequate soluble nitrogen in the root zone when corn is growing is an important factor in corn production. Even with an excess amount of nitrogen there is no way to obtain an excellent crop unless there is a sufficient density of plants to most efficiently utilize the sunlight. Other factors such as drought and diseases may also result in poor nitrogen utilization. It may not be possible to economically provide enough moisture or control of all diseases (such as blight in 1970), but the producer can assure that adequate nitrogen is present with plenty of plants to use the nitrogen and available sunlight.





Nitrogen uptake by corn grown on Lucedale sandy loam 1969-1970, top, and average of 3 years on Lucedale sandy loam and 1 year on Dothan loamy sand, bottom.

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